In the Claims:

Claims 1-42 are currently pending in this application. The listing of claims below will replace all prior versions and listings of claims in the application.

1. (Original) A method of selecting a bit load *b* per sub-channel in a multicarrier system, the multicarrier system encoding data based on a constellation of points, each point representing a tuple of data, the constellation having a self-similarity property, comprising:

selecting the bit load per sub-channel based on the self-similarity property of the constellation.

2. (Original) The method of claim 1 wherein said selecting comprises:

determining a probability of having k bit errors in an erroneous tuple (*p(k,b)*) based on the self-similarity property of the constellation.

3. (Original) The method of claim 2 wherein said determining comprises determining an average number of bit errors in an erroneous tuple based on said probability (*p(k,b)*), and

said selecting is also based on the average number of bit errors in the erroneous tuple.

4. (Original) The method of claim 3 wherein said average number of bit errors in the erroneous tuple is determined as follows:

$$\omega(b) = \frac{12 \cdot 2^b - (3b+2)2^{b/2} - 2b - 4}{6b \cdot 2^b}.$$

5. (Original) The method of claim 2 wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b) = \frac{1}{2^k}\left[1 + \frac{2}{3 \cdot 2^{b/2}}\right] + \frac{1}{2^k}\frac{2}{3}\left[\frac{1}{2^{b/2}} + \frac{2}{2^b}\right]\delta_{1k},\ 1 \le k \le b/2\ .$$

$$\delta_{ij} = \begin{Bmatrix} 1, where i = j \\ 0, where i \ne j \end{Bmatrix}.$$

6. (Original) The method of claim 2 wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b)=\frac{1}{2^k}\left[1+O\left(\frac{1}{2^{b/2}}\right)\right],\ 1\le k\le b/2.$$

7. (Original) The method of claim 2 wherein said probability (*p(k,b)*) approaches $1/2^k$ for constellations which have large values of *b*.

8. (Original) The method of claim 1 wherein said constellation is square.

9. (Original) The method of claim 1 wherein said constellation is non-square.

10. (Original) The method of claim 1 wherein the sub-channel has a bit error rate, and further comprising:

determining a mean square deviation of the number of bit errors in an erroneous tuple;

wherein said selecting further comprises selecting the bit load per sub-channel based on said mean square deviation of the number of bit errors in an erroneous tuple.

11. (Original) The method of claim 10 wherein said mean square deviation of the number of bit errors in an erroneous tuple σ_e is determined based on the following relationship:

$$\sigma_e^2=2-\frac{3b^2+24b+20}{12\cdot 2^{b/2}}+\frac{(6b+4)2^{b/2}-b^2-4}{6\cdot 2^b}+\left(\frac{(3b+2)2^{b/2}+2b+4}{3\cdot 2^b}\right)^2.$$

12. (Original) The method of claim 10 wherein at large values of *b*, the mean square deviation of the number of bit errors in an erroneous tuple σ_e tends to the square root of two.

13. (Original) The method of claim 10 further comprising:

accessing a table of associated values of the number of bits b and the values of the mean square deviation of the number of bit errors in an erroneous tuple to retrieve a value of a particular mean square deviation of the number of bit errors in an erroneous tuple for a particular value of b; and

adjusting a target bit error rate to accommodate said value of said particular mean square deviation of the number of bit errors in an erroneous tuple to provide an

adjusted target bit error rate, wherein said bit load is also selected based on said adjusted target bit error rate.

14. (Original) The method of claim 13 further comprising:

selecting at least one forward error correction parameter based on said adjusted target bit error rate.

15. (Original) The method of claim 1 wherein said selecting comprises:

determining a probability of having k bit errors in an erroneously decoded tuple as follows:

$$p(k,b_1,..,b_J)=\sum_{j=1}^{J}\frac{2^{b_j}}{2^b}p\left(k\middle|symbol\ transmitted\in\Omega_j\ \&\ symbol\ received\in\Omega_j\right)$$
$$+\sum_{\substack{j,m\\m\neq j}}^{J}\left[\begin{array}{l}p\left(symbol\ transmitted\in\Omega_j\ \&\ symbol\ received\in\Omega_m\right)\\ \times p\left(k\middle|symbol\ transmitted\in\Omega_j\ \&\ symbol\ received\in\Omega_m\right)\end{array}\right]$$

where 2^{b_j} is the number of constellation points in each of J adjacent square sub-constellations Ω_j forming a non-square constellation, and sub-constellation Ω_j is different from sub-constellation Ω_m; and $\sum_{j=1}^{J}\frac{2^{b_j}}{2^b}=1$.

16. (Original) The method of claim 2 wherein said constellation is non-square, and said probability of having k bit errors in an erroneously decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation.

17. (Original) The method of claim 2 wherein said constellation is non-square, and said probability of error of said non-square constellation becomes asymptotically close to the probability of error of a square constellation encoder.

18. (Original) The method of claim 1 wherein a parameter having said self-similarity property is a Hamming distance of the points of the constellation.

19. (Original) A method of selecting a bit load b for a channel in a communications system, the communications system encoding data based on a constellation of points, the constellation having a self-similarity property, comprising:

selecting the bit load for the channel based on the self-similarity property of the constellation.

20. (Original) The method of claim 19 wherein the channel has a bit error rate, and further comprising:

determining a mean square deviation of the number of bit errors in an erroneous tuple;

wherein said selecting further comprises selecting the bit load based on said mean square deviation of the number of bit errors in an erroneous tuple.

21. (Original) The method of claim 19 wherein said constellation is non-square, and said selecting comprises:

determining a probability of having k bit errors in an erroneously decoded tuple ($p(k,b)$) based on the self-similarity property of the constellation, wherein said probability of having k bit errors in an erroneously decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation.

22. (Original) The method of claim 19 wherein said self-similarity property is a Hamming distance of the points of the constellation.

23. (Original) An apparatus for selecting a bit load b for a channel in a communications system, the communications system encoding data based on a constellation of points, the constellation having a self-similarity property, comprising:

means for selecting the bit load for the channel based on the self-similarity property of the constellation.

24. (Original) The apparatus of claim 23 wherein the channel has a bit error rate, and said means for selecting further comprises means for determining a mean square deviation of the number of bit errors in an erroneous tuple, wherein said means for selecting selects the bit load based on said mean square deviation of the number of bit errors in an erroneous tuple.

25. (Original) The apparatus of claim 23 wherein said constellation is non-square, and said means for selecting comprises means for determining a probability of having k bit errors in an erroneously decoded tuple ($p(k,b)$) based on the self-similarity property of the constellation, wherein said probability of having k bit errors in an erroneously

decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation.

26. (Original) An apparatus for selecting a bit load *b* per sub-channel in a multicarrier system, the multicarrier system encoding data based on a constellation of points, each point representing a tuple of data, the constellation having a self-similarity property, comprising:

means for determining a bit load per sub-channel based on the self-similarity property of the constellation based on an average fraction of bit errors in an erroneous tuple, and forward error correction parameters;

means for determining a coding gain based on said determined bit load, and forward error correction parameters; and

means for selecting a bit load based on the coding gain.

27. (Original) The apparatus of claim 26 wherein said means for determining said bit load per sub-channel further comprises:

means for determining a probability of having k bit errors in an erroneous tuple (*p(k,b)*) based on the self-similarity property of the constellation.

28. (Original) The apparatus of claim 26 wherein said means for determining said probability comprises determining an average number of bit errors in the erroneous tuple based on said probability (*p(k,b)*), and

said means for selecting also selects the bit load based on the average number of bit errors.

29. (Original) The apparatus of claim 26 wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b) = \frac{1}{2^k}\left[1+\frac{2}{3\cdot 2^{b/2}}\right]+\frac{1}{2^k}\frac{2}{3}\left[\frac{1}{2^{b/2}}+\frac{2}{2^b}\right]\delta_{1k},\ 1 \le k \le b/2\ .$$

$$\delta_{ij} = \begin{Bmatrix} 1, where i = j \\ 0, where i \ne j \end{Bmatrix}.$$

30. (Original) The apparatus of claim 26 wherein said probability (*p(k,b)*) is determined as follows:

$$p(k,b)=\frac{1}{2^k}\left[1+O\left(\frac{1}{2^{b/2}}\right)\right],\ 1\le k\le b/2\ .$$

31. (Original) The apparatus of claim 26 wherein said probability (*p(k,b)*) approaches $1/2^k$ for constellations which have large values of *b*.

32. (Original) The apparatus of claim 26 wherein said constellation is square.

33. (Original) The apparatus of claim 26 wherein said constellation is non-square.

34. (Original) The apparatus of claim 26 wherein the sub-channel has a bit error rate, and said means for determining the bit load further comprises:

means for determining a mean square deviation of the number of bit errors in an erroneous tuple of the bit error rate;

wherein said means for selecting also selects the bit load per sub-channel based on said mean square deviation of the number of bit errors in an erroneous tuple.

35. (Original) The apparatus of claim 34 wherein said means for determining the means square deviation of the number of bit errors in an erroneous tuple determines said mean square deviation of the number of bit errors in an erroneous tuple σ_e in accordance with the following relationship:

$$\sigma_e^2=2-\frac{3b^2+24b+20}{12\cdot 2^{b/2}}+\frac{(6b+4)2^{b/2}-b^2-4}{6\cdot 2^b}+\left(\frac{(3b+2)2^{b/2}+2b+4}{3\cdot 2^b}\right)^2.$$

36. (Original) The apparatus of claim 35 wherein at large values of *b*, □$_e$ tends to the square root of two.

37. (Original) The apparatus of claim 34 further comprising:

means for accessing a table of associated values of the number of bits b and the values of the mean square deviation of the number of bit errors in an erroneous tuple to

retrieve a value of a particular mean square deviation of the number of bit errors in an erroneous tuple for a particular value of b; and

means for adjusting a target bit error rate to accommodate said value of said particular mean square deviation of the number of bit errors in an erroneous tuple to provide an adjusted target bit error rate, wherein said means for selecting also selects said bit load based on said adjusted target bit error rate.

38. (Original) The apparatus of claim 37 wherein said means for selecting selects at least one forward error correction parameter based on said adjusted target bit error rate.

39. (Original) The apparatus of claim 26 wherein said means for determining a bit load comprises:

means for determining a probability of having k bit errors in an erroneously decoded tuple in accordance with the following relationship:

$$p(k,b_1,..,b_J)=\sum_{j=1}^{J}\frac{2^{b_j}}{2^b}p\left(k\middle|symbol\ transmitted\in\Omega_j\ \&\ symbol\ received\in\Omega_j\right)$$
$$+\sum_{\substack{j,m\\m\neq j}}^{J}\left[\begin{array}{l}p\left(symbol\ transmitted\in\Omega_j\ \&\ symbol\ received\in\Omega_m\right)\\ \times p\left(k\middle|symbol\ transmitted\in\Omega_j\ \&\ symbol\ received\in\Omega_m\right)\end{array}\right]$$

where 2^{b_j} is the number of constellation points in each of J adjacent square sub-constellations Ω_j forming a non-square constellation, and sub-constellation Ω_j is different from sub-constellation Ω_m; and $\sum_{j=1}^{J}\frac{2^{b_j}}{2^b}=1$.

40. (Original) The apparatus of claim 26 wherein said constellation is non-square, and said probability of having k bit errors in an erroneously decoded tuple of the non-square constellation is estimated as if said non-square constellation was a square constellation.

41. (Original) The apparatus of claim 26 wherein said constellation is non-square, and said probability of error of said non-square constellation becomes asymptotically close to the probability of error of a square constellation encoder.

42. (Original) The apparatus of claim 26 wherein a parameter having said self-similarity property is a Hamming distance of the points of the constellation.